Interpretation of local abnormalities: Comparison of two fMRI databases - BrainMap versus Neurosynth - with regard to behavioural functional profiles of brain areas in healthy and clinical populations

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Introduction: FMRI studies substantially contribute to our understanding of brain structure-function relationships and the interpretation of local abnormalities. However, imaging neuroscience faces two problems: (1) the rapid growth of the fMRI literature and (2) the lack of a interdisciplinary unified up-to-date coding system, which leads to semantic confusion. The fully-automated fMRI database Neurosynth best addresses the first problem, while its older manually-curated counterpart, BrainMap, best tackles the second issue. This study investigates if the two databases reach similar conclusions despite their different approaches when decoding brain areas.

Methods: We developed a correspondence scheme assigning appropriate Neurosynth terms to terms in the BrainMap taxonomy. This correspondence scheme enabled the comparison of decoding results across databases. The database output were behavioural functional profiles of brain areas showing consistent and selective associations derived by the Forward and Reverse Inference analyses. Eventually, we compared the functional profiles derived by fMRI databases with results from literature search in invasive, animal-based studies.

Results: Overall agreement on behavioral functional profiles between databases was good: interrater reliabilities were excellent for BLA amygdala and nucleus accumbens core and poor for lOFC, mOFC and anterior insula. Compared to results on behavioral functional profiles from invasive animal-based studies in healthy and clinical populations, BrainMap offered less error-prone and misleading results than Neurosynth. Nevertheless, BrainMap often was inferior to Neurosynth in the total amount of studies, which found the same structure-function association.

Discussion: Thus, a future database could integrate a manual and automated coding system at the same time, but keep the Brainmap taxonomy. Thereby the future database could address both issues, the rapid growth of the fMRI literature and the semantic confusion on behavioral functional terms.